

## **SECTION 15820 DUCT ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Sheet Metal materials.
  - 2. Back-draft dampers
  - 3. Manual-volume dampers.
  - 4. Control Dampers (with Pneumatic Operator).
  - 5. Fire dampers.
  - 6. Combination Smoke & Fire Dampers (with Electric Operator)
  - 7. Duct silencers.
  - 8. Turning vanes.
  - 9. Duct-mounted access doors and panels.
  - 10. Flexible connectors.
  - 11. Flexible ducts.
  - 12. Duct accessory hardware.
  - 13. Air-Flow Measuring Station & Control Interface
- B. Related Sections include the following:
  - 1. Division 15, Section 15074, "Identification and Labeling".
  - 2. Division 15, Section 15845, "Air Terminals" for constant-volume and variable-air-volume control boxes, and reheat boxes.
  - 3. Division 15, Section 15855, "Diffusers, Registers, and Grilles."
  - 4. Division 15, Section 15990, "Testing, Adjusting, and Balancing".

#### **1.3 REFERENCES**

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM A366/A366M (1997) Standard Specification for Commercial Steel (CS) Sheet, Carbon.
  - 2. ASTM A653/A653M (1999) Standard Specification for Steel Sheet, Hot-dip coated (Galvanized) by Hot-dip process.
  - 3. ASTM B209/B209M (1996) Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
  - 4. ASTM B221/B221M (1995) Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod & Wire.
  - 5. ASTM E84 (1998) Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 6. ASTM E477 (1996) Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
- B. National Fire Protection Association (NFPA)
  - 1. NFPA 90A (1996) Standards for the Installation of Air Conditioning and Ventilation Systems.

- 2. NFPA 90B (1996) Standards for the Installation of Warm Air Heating and Conditioning Systems.
- C. Sheet Metal & Air Conditioning Contractors' National Association, Inc. (SMACNA)
  - 1. SMACNA DCS HVAC Duct Construction Standards – Metal and (1995; Addendum 1997) Flexible.
- D. Underwriters Laboratories, Inc. (UL)
  - 1. UL 181 (1996) UL Standards for Safety, Factory-Made Air Ducts and Connectors.
  - 2. UL 555 (1995) UL Standards for Safety Fire Dampers
  - 3. UL 555S (1996) UL Standard for Safety Leakage Rated Dampers for Use In Smoke Control Systems.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Backdraft dampers.
  - 2. Manual-volume dampers.
  - 3. Control Dampers (with Pneumatic Operator).
  - 4. Fire dampers.
  - 5. Combination Smoke & Fire Dampers (with Electric Operator).
  - 6. Duct silencers.
  - 7. Duct-mounted access doors and panels.
  - 8. Flexible ducts.
  - 9. Air-Flow Measuring Station assembly.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, methods of field assembly, components, location, and size of each field connection. Detail the following:
  - 1. Special fittings and manual- and automatic-volume-damper installations.
  - 2. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.
- C. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

#### 1.5 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with the following NFPA standards:
  - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
  - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

### PART 2 - PRODUCTS

#### 2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 (Z275) coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.
- C. Aluminum Sheets: ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14, sheet form; with standard, one-side bright finish for ducts exposed to view and mill finish for concealed ducts.

- D. Extruded Aluminum: **ASTM B 221 (ASTM B 221M)**, Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, **1/4-inch (6-mm)** minimum diameter for **36-inch (900-mm)** length or less; **3/8-inch (10-mm)** minimum diameter for lengths longer than **36 inches (900 mm)**.

## 2.2 BACK-DRAFT DAMPERS

- A. Description: Suitable for horizontal or vertical installations.
- B. Frame: **0.052-inch- (1.3-mm-)** thick, galvanized, sheet steel, with welded corners and mounting flange.
- C. Frame: **0.063-inch- (1.6-mm-)** thick extruded aluminum, with mounting flange.
- D. Blades: **0.050-inch- (1.2-mm-)** thick aluminum sheet.
- E. Blade Seals: Neoprene.
- F. Blade Axles: Galvanized steel.
- G. Tie Bars and Brackets: Galvanized steel.
- H. Return Spring: Adjustable tension.

## 2.3 MANUAL-VOLUME DAMPERS

- A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
  - 1. Pressure Classifications of **3-Inch wg (750 Pa)** or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
- B. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, and suitable for horizontal or vertical applications.
  - 1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of **0.064 inch (1.62 mm)** thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
  - 2. Aluminum Frames: Hat-shaped, **0.10-inch- (2.5-mm-)** thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
  - 3. Roll-Formed Steel Blades: **0.064-inch- (1.62-mm-)** thick, galvanized, sheet steel.
  - 4. Roll-Formed Aluminum Blades: **0.10-inch- (2.5-mm-)** thick aluminum sheet.
  - 5. Blade Axles: Galvanized steel.
  - 6. Tie Bars and Brackets: Galvanized steel.
- C. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, and suitable for horizontal or vertical applications.
  - 1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of **0.064 inch (1.62 mm)** thick, with mitered and welded corners; frames with flanges where indi-

- cated for attaching to walls; and flangeless frames where indicated for installing in ducts.
2. Aluminum Frames: Hat-shaped, 0.063-inch- (1.6-mm-) thick, extruded-aluminum channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
  3. Roll-Formed Steel Blades: 0.064-inch- (1.62-mm-) thick, galvanized, sheet steel.
  4. Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
  5. Blade Seals: Neoprene.
  6. Jamb Seals: Neoprene.
  7. Blade Axles: Galvanized steel.
  8. Tie Bars and Brackets: Galvanized steel.
- D. High-Performance Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
1. Steel Frames: Hat-shaped, galvanized steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
  2. Aluminum Frames: Hat-shaped, 0.125-inch- (3-mm-) thick, extruded-aluminum channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
  3. Steel Blades: 0.052-inch- (1.3-mm-) thick, galvanized, sheet steel; airfoil shaped.
  4. Extruded-Aluminum Blades: Minimum of 0.081-inch- (2-mm-) thick, 6063T extruded aluminum.
  5. Blade Seals: Dual-durometer vinyl on blade edges.
  6. Jamb Seals: metallic compression on jambs.
  7. Blade Axles: Galvanized steel.
  8. Tie Bars and Brackets: Galvanized steel.
- E. Jackshaft: 1-inch- (25-mm-) diameter, galvanized steel pipe rotating within a pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
1. Length and Number of Mountings: Appropriate to connect linkage of each damper of a multiple-damper assembly.
- F. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- (2.4-mm-) thick zinc-plated steel, and a 3/4-inch (19-mm) hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

## 2.4 CONTROL DAMPERS. (WITH PNEUMATIC OPERATOR)

- A. General: Control dampers shall be factory fabricated with all required hardware and accessories, including Pneumatic Operator(s) of suitable size and capacity intended for the application indicated on drawings. Stiffen damper blades for stability. Include locking devices to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
1. Pressure Classifications of 3-Inch W.G. (750 Pa) or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
- B. Pneumatic Damper Operator shall be air pressure activated by proportional or two-position pneumatic control devices. Operator shall be of rolling diaphragm type with mounting hardware for external installation to the outside of ductwork. Provide the shaft extension as required for complete installation. Damper Operator shall be complete with a positive-positioning for accurate positioning under varying load conditions.

Coordinate with Division 17, Instrumentation and Controls for related operating pressure, and electrical interface requirements.

- C. Low-Leakage Automatic Control Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, and suitable for horizontal or vertical applications.
1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch (1.62 mm) thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
  2. Aluminum Frames: Hat-shaped, 0.063-inch- (1.6-mm-) thick, extruded-aluminum channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
  3. Roll-Formed Steel Blades: 0.064-inch- (1.62-mm-) thick, galvanized, sheet steel.
  4. Roll-Formed Aluminum Blades: 0.10-inch- (2.5-mm-) thick aluminum sheet.
  5. Blade Seals: Neoprene.
  6. Jamb Seals: Neoprene.
  7. Blade Axles: Galvanized steel.
  8. Tie Bars and Brackets: Galvanized steel.

## 2.5 FIRE DAMPERS (STANDARD)

- A. General: Labeled to UL 555.
- B. Fire Rating: One and one-half hours.
- C. Frame: SMACNA Type B with blades out of airstream; fabricated with roll-formed, ~~0.034-inch-~~ (0.85-mm-) thick galvanized steel; with mitered and interlocking corners.
- D. Mounting Sleeve: Factory- or field-installed galvanized, sheet steel.
1. Minimum Thickness: ~~0.052 inch~~ (1.3 mm) or ~~0.138 inch~~ (3.5 mm) thick as indicated, and length to suit application.
  2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- E. Mounting Orientation: Vertical or horizontal as indicated.
- F. Blades: Roll-formed, interlocking, ~~0.034-inch-~~ (0.85-mm-) thick, galvanized, sheet steel. In place of interlocking blades, use full-length, ~~0.034-inch-~~ (0.85-mm-) thick, galvanized steel blade connectors.
- G. Horizontal Dampers: Include a blade lock and stainless-steel negator closure spring.
- H. Fusible Link: Replaceable, ~~165 or 212 deg F~~ (74 or 100 deg C) rated as indicated.

## 2.6 COMBINATION SMOKE AND FIRE DAMPERS (WITH ELECTRIC OPERATOR)

- A. General: Furnish and install as indicated on drawings, UL555S rated Combination Fire/Smoke Dampers meeting or exceeding the following specifications. Damper shall be as manufactured by Ruskin Model FSD60 low leakage type or approved equal.
1. Frame shall be 5" x 16 gauge minimum galvanized steel formed into a structural hat channel shape with tabbed corners for reinforcement.

2. Damper blades shall be air-foil shaped, double skin construction with 14 gage equivalent thickness, 6" wide maximum.
  3. Blade edge seals shall be silicone rubber and galvanized steel mechanically locked in blade edge (adhesive or clip fastened seals are not acceptable) and shall withstand 450 degrees F. Blade action may be parallel blade or opposed as indicated in damper schedule on drawings. Linkage shall be concealed in frame.
  4. Jamb seals shall be stainless steel flexible metal compression type.
  5. Bearings shall be stainless steel sleeve turning in an extruded hole in the frame.
  6. Damper finish shall be mill galvanized.
- B. Mounting Sleeve: Each Combination Fire/Smoke Damper shall be furnished complete with a factory-assembled sleeve of required length and gage required for satisfactory installation, and with a factory installed damper operator on exterior of sleeve, properly linked to the damper operating shaft. Mounting sleeve shall be 0.052 inch- (1.3-mm-) thick, galvanized steel sheet; length to suit wall or floor applications.
- C. Each combination fire/smoke damper shall be 1-1/2 hour fire rated as per UL Standard 555 and shall further be classified by Underwriters Laboratories as a Leakage Rated Damper for use in smoke control systems under the latest version of UL 555S, and shall bear a UL label attesting to same. Damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and UL qualifying a single damper size is not acceptable. The leakage rating under UL 555S shall be no higher than Leakage Class I (4 CFM/SF at 1 inch WG and 8 CFM/SF at 4 inch WG). As part of the UL qualification, dampers shall have demonstrated a capacity to operate (to open and close) under HVAC system operating conditions with pressures of at least 4 inches WG in the closed position, and 4,000 FPM air velocity in the open position. .
- D. Damper Operators (Motors): In addition to the leakage ratings already specified herein, the combination fire smoke dampers and their actuators shall be qualified under UL 555S to an elevated temperature of 350 degrees F, depending upon the operator. At the time of the damper fabrication, the damper manufacturer shall install a suitable size, capacity and rating electric operator. Damper and operator shall be supplied as a single entity that meets all applicable UL 555 and UL 555S qualifications for both dampers and actuators.

Damper and operator/actuator assembly shall be factory cycled 10 times to assure operation. Provide for modulating or two-position action. Operators / Motors are as follows:

1. Operators shall be of the "spring-return" "Fail-safe" type that will close the damper upon power interruption. Damper operator shall be equipped with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
  3. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
  4. Two-Position Motor: 120 V, 1 phase, 60 Hz.
  5. Modulating, Spring-Return Motor: 120 V, 1 phase, 60 Hz.
- E. Each combination fire smoke damper shall be equipped with a UL Classified "Fire-Stat" control package assembly. The assembly shall electrically and mechanically lock the damper in a closed position when duct temperatures exceed 212 degrees F, and still allow appropriate authority to override the Fire-Stat and operate damper as may be required for smoke control

functions. Damper must be operable while temperature is above 250 degrees F. Fire-Stat package shall include **two** (2) damper position indicator switches linked directly to damper blade to provide capability of remotely indicating damper position. One switch shall close when damper is fully open; the other switch shall close when damper is fully closed. Fire-Stat and position indicator switches shall be capable of interfacing electrically with:

- a. Building Smoke detection system.
- b. Building fire alarm systems.
- c. Remote indicating/control stations.

Fire-Stat shall be equipped with High Limit Temperature Sensor that meets all requirements of NFPA 92A by returning damper to fire protection mode when temperatures reach 350 degrees F, which is the operational limit of the damper and actuator assembly.

Fire-Stat controller shall be as manufactured by "Ruskin", Model TS150 Fire-Stat package or approved equal.

## 2.7 DUCT SILENCERS

- A. General: Factory-fabricated and -tested, round or rectangular silencer with performance characteristics and physical requirements as indicated.
- B. Fire Performance: Adhesives, sealers, packing materials, and accessory materials shall have fire ratings not exceeding 25 for flame spread and 50 for smoke developed when tested according to ASTM E 84.
- C. Rectangular Units: Fabricate casings with a minimum of **0.034-inch- (0.85-mm-)** thick, solid sheet metal for outer casing and **0.022-inch- (0.55-mm-)** thick, perforated sheet metal for inner casing.
- D. Round Units: Casings with sheet metal thicknesses for diameters listed below:
  1. Up to **24 Inches (600 mm): 0.034 inch (0.85 mm).**
  2. **26 through 40 Inches (660 through 1,000 mm): 0.040 inch (1.0 mm).**
  3. **42 through 52 Inches (1,060 through 1,300 mm): 0.052 inch (1.3 mm).**
  4. **54 through 60 Inches (1,370 through 1,500 mm): 0.064 inch (1.62 mm).**
  5. Casings fabricated of spiral lock-seam duct may be one size thinner than that indicated.
  6. Interior Partitions and Baffles: At least **0.034 inch (0.85 mm)** and designed for minimum aerodynamic losses.
- E. Sheet Metal Perforations: **1/8-inch (3-mm)** diameter for inner casing and baffle sheet metal.
- F. Fibrous Acoustic-Fill Material: Inert and vermin-proof fibrous material, packed under not less than 5 percent compression.
- G. Fabricate silencers to form rigid units that will not pulsate, vibrate, rattle, or otherwise react to system pressure variations.
  1. Do not use nuts, bolts, and sheet metal screws for unit assemblies.
  2. Lock form and seal or continuously weld joints.
  3. Suspended Units: Factory-installed suspension hooks or lugs attached to frame in quantities and spaced to prevent deflection or distortion.
  4. Reinforcement: Cross or trapeze angles for rigid suspension.

- H. Source Quality Control: Perform the following factory tests:
  - 1. Acoustic Performance: Test according to ASTM E 477, with airflow in both directions through silencer.
  - 2. Record acoustic ratings, including dynamic insertion loss and self-noise power levels, for both forward flow (air and noise in same direction) and reverse flow (air and noise in opposite directions) with an airflow of at least 2,000-fpm (10-m/s) face velocity.
  - 3. Leak Test: Test units for airtightness at 200 percent of associated fan static pressure or 6-inch wg (1,500-Pa) static pressure, whichever is greater.

## 2.8 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

## 2.9 DUCT-MOUNTED ACCESS DOORS AND PANELS

- A. General: Fabricate doors and panels airtight and suitable for duct pressure class.
- B. Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.
- C. Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- E. Insulation: 1-inch- (25-mm-) thick, fibrous-glass or polystyrene-foam board.

## 2.10 FLEXIBLE CONNECTORS

- A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.
- C. Transverse Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches (89 mm) wide attached to two strips of 4-3/8-inch- (111-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized, sheet steel or 0.032-inch (0.8-mm) aluminum sheets. Select metal compatible with connected ducts.
- D. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.
  - 1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
  - 2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp, and 360 lbf/inch (63 N/mm) in the filling.
- E. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.



1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
  2. Tensile Strength: 530 lbf/inch (93 N/mm) in the warp, and 440 lbf/inch (77 N/mm) in the filling.
- F. High-Corrosive-Environment System Flexible Connectors: Glass fabric coated with a chemical-resistant coating.
1. Minimum Weight: 14 oz./sq. yd. (474 g/sq. m).
  2. Tensile Strength: 450 lbf/inch (79 N/mm) in the warp, and 340 lbf/inch (60 N/mm) in the filling.

## 2.11 FLEXIBLE DUCTS

- A. General: Comply with UL 181, Class 1.
- B. Flexible Ducts, Uninsulated: Spiral-wound steel spring with flameproof vinyl sheathing.
- C. Flexible Ducts, Uninsulated: Corrugated aluminum.
- D. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch- (38-mm-) thick, glass-fiber insulation around a continuous inner liner.
1. Reinforcement: Steel-wire helix encapsulated in inner liner.
  2. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.
  3. Inner Liner: Polyethylene film.
- E. Pressure Rating: 6-inch wg (1,500 Pa) positive, 3/4-inch wg (187 Pa) negative.

## 2.12 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.
- B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch (6-mm), zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.
- C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches (75 to 450 mm) to suit duct size.
- D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## 2.13 AIR-FLOW MEASURING STATION (AFMS)

- A. Provide as indicated on drawings, size and capacity "Airflow Probe Transverse Station" capable of continuously monitoring the quantity of (moderately disturbed) airflow volumes transported in the ductwork. Each AFMS shall utilize one or more VOLUME-probes, factory mounted in a rigid welded galvanized (or Stainless Steel as indicated for specific service) casing, to sense and average separate total and static pressure traverses of an air stream with a certified accuracy of 2% or better when tested according to AMCA 610. Each station contain multiple sets of "Fechheimer Pitot" total and static pressure sensing ports, positioned on an equal area basis along the length of each probe, transverse the duct cross-section and average the sensed pressures in separate internally connecting manifolds. For stations of 4 square feet or less, one total and one static pressure sensor shall be present for every

16 square inches of station area respectively. For stations of larger area, one total and one static pressure sensor shall be present for every 36 square inches of station area respectively.

- B. The stations shall have minimal self-generated sound rating, and the sound level within the duct shall not be amplified, nor shall additional sound be generated.
- C. The airflow measuring station shall be as fabricated by Air Monitor Corporation, Model "VOLU-Probe / VS Airflow Probe Traverse Station" or approved equal.
- D. Each station shall be complete with an open parallel cell airflow "straightener" or air equalizer honeycomb upstream of probes, mechanically fastened to the casing. An identification label shall be placed on each station casing listing model number, size, area, and specified airflow capacity.
- E. Control interface: Each station shall be complete (shipped loose, installed by control contractor) with a matching capacity range of "Differential Pressure / Flow transmitter" in a NEMA 12 enclosure. Transmitter shall be microprocessor based, ultra-low differential pressure and flow "smart" type with a 0.15% of Natural Span accuracy suitable for HVAC applications. Transmitter shall be analog output configurable for 4-20 mADC, AUTO-zero capability, digital low pass filter, and 5:1 turndown capability. Provide a suitable 12VAC to 24VDC transformer as part of the package. Air Monitor, Model "VELTRON DPT 2500-plus" or approved equal.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.
- B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.
- C. Provide test holes at fan inlet and outlet and elsewhere as indicated.
- D. Install fire and smoke dampers according to manufacturer's UL-approved written instructions.
  - 1. Install fusible links in fire dampers.
- E. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.
  - 1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
  - 2. Install access panels on side of duct where adequate clearance is available.
- F. Label access doors according to Division 15, Section 15074, "Identification and Labeling."

#### 3.2 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire dampers for proper action.

- C. Final positioning of manual-volume dampers is specified in Division 15, Section 15990, "Testing, Adjusting, and Balancing."

**END OF SECTION 15820**